

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings of claims in the application:

Listing of Claims:

- 1 1. (Currently amended): An image sensor comprising:
2 a semiconductor substrate of a first conductivity type;
3 a peripheral circuit formed on a first region of the semiconductor substrate,
4 wherein a ground voltage level is applied to the first region;
5 a unit pixel array having a plurality of unit pixels formed on a second region of
6 the semiconductor substrate, wherein the first region is isolated from the second region and
7 wherein a negative voltage level is applied to the second region; and
8 a buried layer isolating each of the unit pixels so that the buried layer surrounds
9 each of the unit pixels; and
10 a negative voltage circuit configured to provide the negative voltage for the
11 second region;
12 wherein the semiconductor substrate comprises a P+-type substrate and a P-type
13 epitaxial layer that is formed in the P+-type substrate,
14 wherein the buried layer is formed in the P-type epitaxial layer,
15 wherein the negative voltage circuit comprises a P+ diffusion layer that is formed
16 in the P-type epitaxial layer and wherein the negative voltage is applied to the P+ diffusion layer.

2 - 4. (Canceled)

- 1 5. (Currently amended): The image sensor as recited in claim [[4]]1,
2 wherein the P+ diffusion layer is shared with the second region of neighboring pixels.

1 6. (Currently amended): An image sensor, comprising:
2 a plurality of unit pixels formed in a first region of a substrate that is biased at a
3 ground reference, each pixel surrounded by a first epitaxial layer that is biased at a negative
4 potential relative to the ground reference; and
5 a bias generator formed in a second region of the substrate that is biased to the
6 ground reference,
7 wherein the substrate comprises a P+-type substrate and the first epitaxial layer is
8 a P-type epitaxial layer that is formed in the P+-type substrate,
9 wherein a buried layer surrounds the first epitaxial layer,
10 wherein the bias generator comprises a P+ diffusion layer that is formed in the P-
11 type epitaxial layer and wherein the negative potential is applied to the P+ diffusion layer.

7 - 14. (Canceled)

1 15. (Currently amended): A method of improving the charge transfer
2 efficiency of a photodiode device, the method comprising the steps of:
3 providing a ground reference in a first region formed in a substrate;
4 providing a bias generator in the first region for generating a negative potential
5 relative to the ground reference; and
6 providing a photodiode device in a second region formed in the substrate
7 including spacing apart the first region and the second region and isolating the second region
8 from the first region, the photodiode device having a photodiode including a p-type side that is
9 electrically coupled to the negative potential, wherein the substrate comprises a P+-type
10 substrate and the photodiode is disposed in a P-type epitaxial layer that is formed in the P+-type
11 substrate; and
12 providing a buried layer that surrounds the P-type epitaxial layer,
13 wherein the bias generator comprises a P+ diffusion layer that is formed in the P-
14 type epitaxial layer and wherein the negative potential is applied to the P+ diffusion layer.